

Sub G4
43
contd

45. A semiconductor device claimed in Claim 44, wherein said predetermined distance is in the range of not less than 10% but not greater than 40% of a thickness of said insulator film.

46. A semiconductor device claimed in Claim 43, wherein said predetermined distance is in the range of not less than 10% but not greater than 40% of a thickness of said insulator film.--

REMARKS

Claims 11 and 20 have been amended. Claims 29-46 have been added to further scope the invention.

Pursuant to 37 CFR § 1.121, a marked copy of the amended claim showing the changes made therein accompanies this Amendment. No new matter has been entered.

Turning to the rejection of claims 11-28 under 35 USC §103 as obvious over U.S. Patent 5,534,461 to Kuwajima in view of U.S. Patent 5,730,835 to Roberts et al., U.S. Patent 4,507,853 to McDavid, U.S. Patent 5,714,804 to Miller et al., and U.S. Patent 5,591,675 to Kim et al., claims 11 and 20 have been amended to specify that the large and small contact holes "reach . . . the semiconductor substrate." Kuwajima teaches large and small contact holes that reach a well layer formed on the semiconductor substrate (col. 3, lines 15-25; Figure 3), and a small contact hole filled with a W layer that contacts a barrier metal film (col. 4, lines 9-11; col. 5, lines 5-10; Figures 3-6). Kuwajima fails to teach large and small contact holes that reach the semiconductor substrate and a small contact hole whose plug contacts the semiconductor substrate. Further, Roberts et al., McDavid, Miller et al., and Kim et al. fail to disclose large and small contact holes, an omission which has been extensively discussed in earlier prosecution and previous two appeal briefs. Because Kuwajima, in combination with Roberts et al., McDavid, Miller et al.,

and Kim et al., does not teach this aspect of claims 11 and 20, Kuwajima cannot render obvious the instant claims, nor any claims dependent therefrom.

Having dealt with all the objections raised by the Examiner, the application is believed to be in order for allowance. Early and favorable Action are respectfully requested.

A credit card payment Form PTO 2038 authorizing payment of \$356.00 in payment of the added claims accompanies this Amendment. In the event there are any fee deficiencies or additional fees are payable, please charge them (or credit any overpayment) to our deposit account number 08-1391.

Respectfully submitted

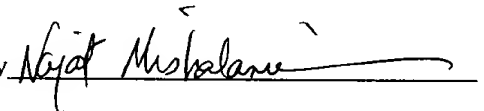


Norman P. Soloway
Attorney for Applicant
Registration No. 24,315

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: BOX RCE, Assistant Commissioner of Patents and Trademarks, Washington, D.C. 20231 on APR. 11, 2002, at Tucson, Arizona.

By



NPS:nm

HAYES SOLOWAY P.C.

130 W. CUSHING ST.
TUCSON, AZ 85701
TEL. 520.882.7623
FAX. 520.882.7643

175 CANAL STREET
MANCHESTER, NH 03101
TEL. 603.668.1400
FAX. 603.668.8567



MARKED CLAIMS SHOWING CHANGES MADE

11. (Amended) A semiconductor device including both a large-diameter contact hole and a small-diameter contact hole formed to penetrate through an insulator film formed on a [conductive portion] semiconductor substrate to reach said [conductive portion] semiconductor substrate, each of said large-diameter contact hole and said small-diameter contact hole having a constant-diameter portion formed on a lower portion thereof, and a funnel-shaped portion formed on an upper portion thereof to open or spread upward, said small-diameter contact hole being completely filled with a plug of a refractory conductive material which contacts said semiconductor substrate, and said large-diameter contact hole being partly filled by said refractory conductive material which covers a sidewall surface of said large-diameter contact hole excluding said funnel-shaped portion, to a position which is lower than a lower end of said funnel-shaped portion by a predetermined distance, a wiring conductor layer being deposited on said insulator film to cover a top surface of said plug of said refractory conductive material and to fill at least in part space remaining in said large-diameter contact hole thereby to cover a bottom of said large-diameter contact hole and a surface of said sidewall of said refractory conductive material within said large-diameter contact hole, and to cover a surface of said funnel-shaped portion of said large-diameter contact hole.

20. (Amended) A semiconductor device including both a large-diameter contact hole and a small-diameter contact hole formed to penetrate through an insulator film formed on a [conductive portion] semiconductor substrate to reach said [conductive portion] semiconductor substrate, each of said large-diameter contact hole and said small-diameter contact hole having a funnel-shaped portion formed on an upper portion thereof to open or spread upward, said small-

diameter contact hole being completely filled with a plug of a refractory conductive material which contacts said semiconductor substrate, and said large-diameter contact hole being partly filled by said refractory conductive material which covers a sidewall surface of said large-diameter contact hole excluding said funnel-shaped portion, to a position which is lower than a lower end of said funnel-shaped portion by a predetermined distance, said refractory conductive material covering said sidewall surface of said large-diameter contact hole having a thickness on a lower portion of said hole, equal to about half the diameter of the small-diameter contact hole, a wiring conductor layer being deposited on said insulator film to cover a top surface of said plug of said refractory conductive material and to fill at least in part space remaining in said large-diameter contact hole thereby to cover a bottom of said large-diameter contact hole and a surface of said sidewall of said refractory conductive material within said large-diameter contact hole, and to cover a surface of said funnel-shaped portion of said large-diameter contact hole.